

ASTR288C

Homework 1

Due: 14 September

1. Find the celestial equatorial coordinates of Vega. Do not forget to include the epoch.

RA, Dec = 18^h 36^m 56.336^s, +38° 47' 01.29" (J2000.0)

From SIMBAD

**<http://simbad.u-strasbg.fr/simbad/sim-id?Ident=vega&NbIdent=1&Radius=2&Radius.unit=arcmin&submit=submit+id>
on 2009 Aug 27**

2. Vega has an apparent V -band magnitude of $m_V = 0.03$ mag. Assuming a photometric zero point of $K_V = -48.64$ what is the observed flux density of this star? The units of flux density for this zero point are $\text{erg cm}^{-2} \text{s}^{-1} \text{Hz}^{-1}$.

$$m_V = K_V - 2.5 \log_{10}(f) \quad \text{solve for } f$$

$$f = 10^{((K_V - m_V) / 2.5)}$$

$$f = 10^{((-48.64 - 0.03) / 2.5)}$$

$$f = 3.40 \times 10^{-20} \text{ (erg cm}^{-2} \text{ s}^{-1} \text{ Hz}^{-1}\text{)}$$

3. Vega is at a distance of $d = 7.76$ parsecs. What is its absolute magnitude?

$$M = m + 5 - 5 \log_{10}(d) \quad \text{solve for } d$$

$$M = 0.03 + 5 - 5 \log_{10}(7.76)$$

$$M = 0.58 \text{ (mag)}$$

4. Two stars in a binary system each have an apparent magnitude of $m_V = 10$ mag. What is the total apparent magnitude of the binary system? Assume that the zero point is $K_V = -48.64$.

Magnitudes are not additive, but flux densities are. Solve for the flux density of each star.

$$m_1 = K_V - 2.5 \log_{10}(f_1)$$

$$f_1 = 10^{((K_V - m_V) / 2.5)}$$

$$f_1 = 10^{((-48.64 - 10) / 2.5)}$$

$$f_1 = 3.50 \times 10^{-24} \text{ (erg cm}^{-2} \text{ s}^{-1} \text{ Hz}^{-1}\text{)}$$

$$f_2 = f_1$$

Add the two flux densities to get the total observed flux density for the binary system.

$$f = f_1 + f_2 = 2 \times 3.50 \times 10^{-24} = 7 \times 10^{-24} \text{ (erg cm}^{-2} \text{ s}^{-1} \text{ Hz}^{-1}\text{)}$$

Compute the total magnitude from the total flux density.

$$m = K_V - 2.5 \log_{10}(f)$$

$$m = -48.64 - 2.5 \log_{10}(7 \times 10^{-24})$$

$$\mathbf{m = 9.25 \text{ (mag)}}$$

5. Hand in the list of files that you created and printed in the lab.
6. Hand in the image that you printed in the lab. Include the source of the image.